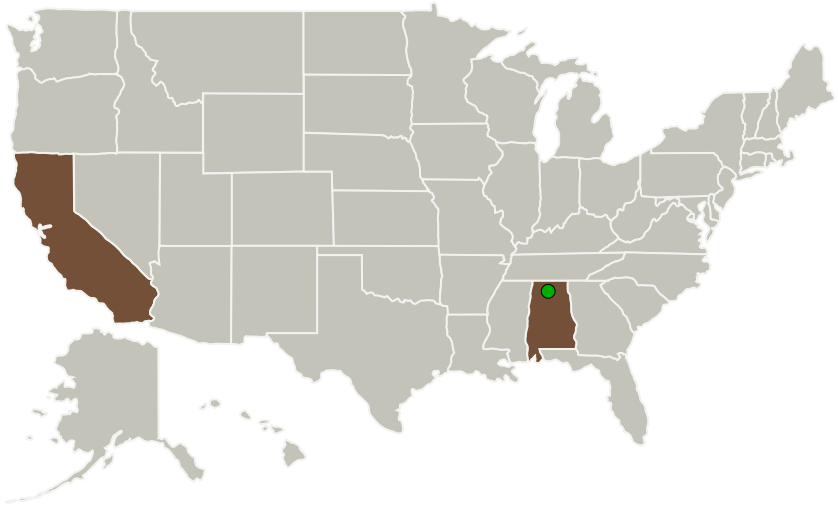
Silicon Carbide Lightweight Optics With Hybrid Skins for Large Cryo Telescopes, Phase II

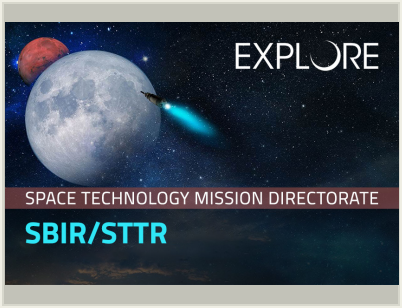
Completed Technology Project (2011 - 2017)

Project Introduction

Optical Physics Company (OPC) has developed new silicon carbide (SiC) foam-based optics with hybrid skins that are composite, athermal and lightweight (FOCAL) that provide an enabling capability for performing NASA space missions that will require 2 to 3 meter class cryogenic mirrors for infrared telescopes. The key development in the Phase I program was the replacement of OPC monolithic SiC skins with SiC fiber reinforced/SiC CVD hybrid skins on 1.5" coupons, 4" flat and then 12" powered optics. This innovation avoids scale-up problems that include the inherent stress in the monolithic skins which can result in skin cracking during the substrate manufacturing and finishing processes, the non-uniformity of the .040"-.050" thick monolithic skins that typically require .010"-.015" of material removal before a continuous surface can be achieved for optical finishing, the long schedule of manufacturing the mirror substrate, and the large $2M/m2 cost to produce the polished mirror. The hybrid skin technology provides increased skin strength and toughness to enable the foam based technology to produce meter class mirrors without skin cracking. The manufacturing time and CVD chamber cost are reduced because premanufactured SiC fibers are used to provide the bulk of the skin mass rather than laying down a monolithic skin atom by atom via CVD. The net effect is to produce a SiC FOCAL mirror substrate that is stronger, tougher, scalable to meter class, and potentially better than 50% faster and cheaper to manufacture. OPC proposes to demonstrate that the hybrid skin technology developed in Phase I can be successfully applied to manufacture a 22" diameter F/2 spherical SiC FOCAL hybrid skin substrate and then polish it into a precision mirror on a Phase II program.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Optical Physics Company	Lead Organization	Industry	Calabasas, California
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	California

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Optical Physics Company

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

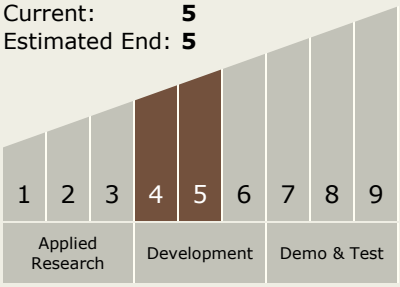
Carlos Torrez

Principal Investigator:

Marc Jacoby

Technology Maturity (TRL)

Start: **4**
Current: **5**
Estimated End: **5**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.2 Observatories
    - TX08.2.1 Mirror Systems

Target Destinations

The Moon, Mars, Outside the Solar System, The Sun, Earth, Others Inside the Solar System